

# A Study on the Effect of the Anodic Oxide Coating in the Piston Top Ring Groove on the Running-in Process and Oil Consumption

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Reducing Lubricating Oil Consumption (LOC) of an engine is critical for meeting recent strict emission regulations, as it directly affects PM (Particulate matter) and PN (Particulate matter number) emissions. The ring grooves of aluminum pistons are sometimes anodized to prevent aluminum adhesion, but this treatment increases surface roughness. It was assumed that surface texture affects running-in process and also oil retention; hence oil travel upward i.e. LOC. In this study, pistons with anodic oxide coatings of varying surface roughness were prepared, and the effect of surface roughness on LOC was investigated.

The sulfur-tracer method was used to measure oil consumption. A mono-cylinder gasoline engine was used for the tests. Table 1 shows surface treatment of top ring grooves for the tested pistons. The top ring groove of piston No.1 was anodized and the pits were sealed, and that of No.2 was anodized in a same manner as that for No.1 without sealing. The top ring groove of piston No.3 was anodized and the pits were sealed but the surface was smoother than those of pistons Nos.1 and 2. For the piston No.4, no surface treatment was applied. Two types of tests were conducted. In Test 1, the load was increased after 2300 seconds operations, while the engine speed was kept constant, in order to evaluate the effect on oil consumption reduction during the transient period. In Test 2, steady-state operation was performed to evaluate the initial running-in process.

Table 1 Surface treatment of top ring groove

| No. | Surface treatment |          | Surface Roughness |     |
|-----|-------------------|----------|-------------------|-----|
|     |                   |          | Ra                | Rpk |
| 1   | Anodizing         | Sealed   | 1.4               | 2.0 |
| 2   | Anodizing         | Unsealed |                   |     |
| 3   | Anodizing         | Sealed   | 1.0               | 0.9 |
| 4   | None              |          | 0.1               | 0.2 |

Figure 1 shows the results of Test 1. It was found that pistons with an anodic oxide coating applied to the piston ring groove reduced LOC after changing load from 1/5 load to half-load.

Figure 2 shows the results of Test 2. It was found that the rougher the surface roughness of the piston top ring groove, the faster the progression of initial running-in.

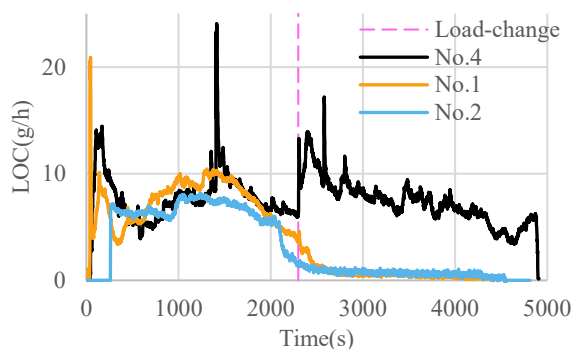


Fig.1 Effect of load change on LOC for various surface treatment

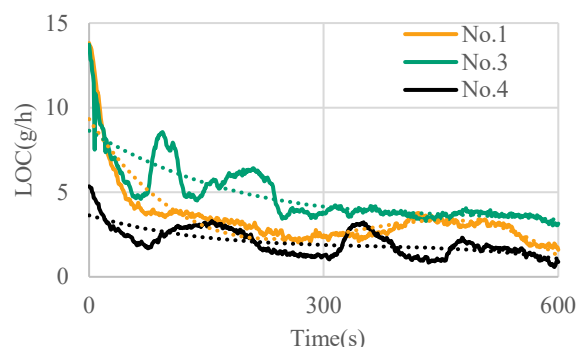


Fig.2 Oil Consumption of running-in process